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RAILWAY TRACK SCALE TESTING SERVICE
OF THE
NATIONAL BUREAU OF STANDARDS

FISCAL YEAR 1942 (JULY 1, 1941 to JUNE 30, 1942)

This report of the activity of the National Bureau of Standards in the sphere of railway track scale weighing is one of a series of annual reports on this subject. The present report is presented in greatly condensed form as compared with earlier reports of the series; this action is deemed consonant with prevailing war conditions. Basic statistical data are included, but most analyses and "break-downs" are omitted.

I. ABSTRACT OF 1942 FIELD ACTIVITIES

1. Master railway track scales calibrated, 18
2. Railway track scale test-weight cars:
 - (a) Standardizations on Bureau master scale, 50
 - (b) Weighings in the field, 16
3. Commercial railway track scales:
 - (a) Total number tested, 1033
 - (1) Railroad-owned, 510, or 49.4% of total
 - (2) Industry-owned, 523, or 50.6% of total
 - (b) States in which tests were made, 35
 - (c) Railroads on whose lines tests were made, 119
4. Locomotive wheel-load scales tested, 2

II. MASTER RAILWAY TRACK SCALES

Eighteen of the nineteen master railway track scales located throughout the country were calibrated during the year. Fifteen of these were found to be accurate within adjustment tolerances; as found, the three remaining scales were accurate well within the maintenance tolerances, and were subsequently adjusted and left weighing within the adjustment tolerances. The counterpoise weights used with eight of the calibrated scales were tested; only three weights were found to have errors in excess of the prescribed tolerances.

III. COMMERCIAL RAILWAY TRACK SCALES

The 1033 scales tested during the year include 203 scales which had not formerly been tested by the Bureau and 52 scales which had not been tested for 10 or more years.

All scales tested have been classified as "accurate" or "inaccurate" upon the basis of their weighing performance as found, the criterion being a basic maintenance tolerance of $\pm 0.20\%$, and a limiting sectional tolerance of $\pm 0.30\%$. (Only 2 railroad-owned and 6 industry-owned scales, otherwise accurate, became "inaccurate" by reason of the sectional tolerance.) A statistical summary of test results on all scales tested, including scales in grain-weighing service, is presented in Table 1; the frequency distribution of railway track scale errors is shown by Table 2.

Corrective adjustments and/or slight corrections were undertaken on 61 railroad-owned and 64 industry-owned scales, some of which had been found to be accurate on original tests. Twenty-three originally inaccurate railroad-owned scales and 31 originally inaccurate industry-owned scales were found to be accurate upon retests following adjustments or corrections, and in all remaining cases the corrective measures resulted in an improvement of the weighing performance.

TABLE 1. SUMMARY OF RAILWAY TRACK SCALE TEST DATA, BASED ON
CONDITIONS AS FOUND

(Figures not in parentheses are for the Fiscal Year 1942; figures in parentheses are for the Fiscal Year 1941, and are included for purposes of comparison.)

poses of comparison.

District and scale ownership	Number of scales tested	Accurate		Inaccurate		Numerical mean of maximum percentage errors
		Num- ber	Per- cent	Num- ber	Per- cent	
EASTERN						
Railroad	93 (242)	80 (193)	86.0 (79.8)	13 (49)	14.0 (20.2)	0.15 (0.14)
Industry	52 (165)	42 (134)	80.8 (81.2)	10 (31)	19.2 (18.8)	0.23 (0.20) ^a
Totals	145 (407)	122 (327)	84.1 (80.3)	23 (80)	15.9 (19.7)	0.17 (0.17) ^b
SOUTHERN						
Railroad	99 (214)	84 (152)	84.8 (71.0)	15 (62)	15.2 (29.0)	0.14 (0.22)
Industry	87 (115)	67 (65)	77.0 (56.5)	20 (50)	23.0 (43.5)	0.21 (0.24)
Totals	186 (329)	151 (217)	81.2 (66.0)	35 (112)	18.8 (34.0)	0.17 (0.22)
WESTERN						
Railroad	318 (191)	272 (170)	85.5 (89.0)	46 (21)	14.5 (11.0)	0.14 (0.12)
Industry	384 (109)	271 (90)	70.6 (82.6)	113 (19)	29.4 (17.4)	0.23 (0.29)
Totals	702 (300)	543 (260)	77.4 (86.7)	159 (40)	22.6 (13.3)	0.19 (0.18)
ALL DISTRICTS						
Railroad	510 (647)	436 (515)	85.5 (79.6)	74 (132)	14.5 (20.4)	0.14 (0.16)
Industry	523 (389)	380 (289)	72.7 (74.3)	143 (100)	27.3 (25.7)	0.23 (0.24) ^c
Grand Totals	1033 (1036)	816 (804)	79.0 (77.6)	217 (232)	21.0 (22.4)	0.18 (0.19) ^d

In computing the values (a), (b), (c), and (d), one scale with the abnormally large error of 18.12 percent was excluded; otherwise these values would have been, respectively, 0.31%, 0.21%, 0.28%, and 0.21%.

TABLE 2. FREQUENCY DISTRIBUTION OF RAILWAY TRACK SCALE ERRORS,
BASED ON CONDITIONS AS FOUND

Error Groups	EASTERN DISTRICT				SOUTHERN DISTRICT				WESTERN DISTRICT				ALL DISTRICTS	
	Rail-road		Indus-try		Rail-road		Indus-try		Rail-road		Indus-try		Rail-road	
	Percent of 93 scales tested	Percent of 52 scales tested	Percent of 99 scales tested	Percent of 87 scales tested	Percent of 318 scales tested	Percent of 384 scales tested	Percent of 510 scales tested	Percent of 523 scales tested	Percent of 318 scales tested	Percent of 384 scales tested	Percent of 510 scales tested	Percent of 523 scales tested	Percent of 318 scales tested	Percent of 384 scales tested
Scales accurate within:														
1/4 basic tolerance	17.2	28.9	26.3	10.4	27.4	13.8	25.3	14.7	61.9	37.0	61.4	39.2	25.3	14.7
1/2 " "	54.8	55.8	65.7	39.1	61.9	37.0	61.4	39.2	76.4	56.8	74.5	60.6	61.4	39.2
3/4 " "	67.7	75.0	74.8	69.0	76.4	56.8	74.5	60.6	85.5	70.6	85.5	72.7	74.5	60.6
Full " "	86.0	80.8	84.8	77.0	85.5	70.6	85.5	72.7						
Scales inaccurate by more than:														
Basic tolerance (a)	14.0	19.2	15.2	23.0	14.5	29.4	14.5	27.3	4.7	9.9	5.3	10.1	14.5	27.3
Twice basic tolerance	5.4	9.6	7.1	11.4										
2 1/2 times basic tolerance	3.2	7.7	4.1	8.0	3.1	8.6	3.3	8.4						
Mean numerical errors														
Accurate scales	0.11	0.09	0.09	0.11	0.09	0.11	0.09	0.11	0.44	0.52	0.42	0.55	0.09	0.11
Inaccurate scales	0.39	0.81	0.42	0.56	0.44	0.52	0.42	0.55	0.14	0.23	0.14	0.23	0.42	0.55
All scales, 1942	0.15	0.23	0.14	0.21	0.14	0.21	0.14	0.23					0.14	0.23
Mean numerical errors, 1941														
All scales, 1941	0.14	0.20(b)	0.22	0.24	0.12	0.29	0.16	0.24(c)					0.16	0.24(c)

(a) Including scales of more than two sections, inaccurate only by reason of sectional errors in excess of 0.30 percent.
 (b) and (c) In computing these values, one scale with the abnormally large error of 18.12 percent was excluded; otherwise these values would have been, respectively, 0.31% and 0.28%.

IV. SCALES IN GRAIN-WEIGHING SERVICE

A special tolerance of $\pm 0.10\%$ is applicable to scales in grain-weighing service. For general statistical purposes, grain scales have been included in the total group reported upon in Tables 1 and 2. Test data for industry-owned grain scales alone, based on the special tolerance cited, are given in Table 3; figures for the two preceding years, and figures for the mean numerical errors of all industry-owned scales, are included for purposes of comparison.

TABLE 3. SUMMARY OF DATA ON RAILWAY TRACK SCALES
IN GRAIN-WEIGHING SERVICE

Fiscal Year	Number of scales tested	Within special grain-scale tolerance		Not within special grain- scale tolerance		Numerical mean of maximum percentage error	
		Number	Percent	Number	Percent	Grain scales	All indus- try scale
1940	52	32	61.5	20	38.5	0.15	0.19
1941	71	55	77.5	16	22.5	0.10	0.28
1942	95	51	53.7	44	46.3	0.18	0.23

V. SCALES AT COAL MINES

A special effort was made during the year to test industry-owned scales at coal mines in the Western District, many of which had not previously been tested by the Bureau; 94% of the coal-mine scales reported upon below were in the Western District. Data for comparison are included in Table 4.

TABLE 4. SUMMARY OF DATA ON RAILWAY TRACK SCALES
AT COAL MINES

Coal Mine Scales			All Industry			Industry other than Coal Mine		
Num- ber	Percent accurate	Mean error	Num- ber	Percent accurate	Mean error	Num- ber	Percent accurate	Mean error
117	59.8	0.37	523	72.7	0.23	406	76.4	0.19

VI. RAILWAY TRACK SCALE TEST-WEIGHT CARS

Fifty standardizations of railway track scale test-weight cars were made on the Bureau master scale at Clearing, Ill.; 30 cars were involved, 15 of which conformed reasonably well to recommended specifications, and all but one of which were owned by railroads. The nominal weights of these cars ranged from 30,000 to 92,500 pounds; 17 cars had nominal weights of 80,000 pounds. Three of the cars had not previously been submitted to the Bureau, but one of these was submitted three times during the year. Excluding the three "first submissions", the frequency of submission is shown by the following tabulation of the periods elapsing between successive standardizations:

2 months	3 instances
3-6 months	20 instances
7-12 months	19 instances
14 months	1 instance
24-26 months	3 instances
27 months	1 instance
Average interval, 7 months	

Considering all cars submitted for standardization, errors found ranged from 1 pound to 867 pounds, the weights of 18 cars being found in excess of their nominal weights, and the weights of 32 cars being found less than their nominal weights. However, in the case of 31 standardizations, there was information or evidence that the cars had been repaired or altered since the last preceding standardization; excluding this group, it is found that on the remaining 19 standardizations the cars as submitted had errors ranging from 1 pound to 55 pounds, 8 being heavy (average 14 pounds) and 11 light (average 12 pounds), the average numerical error (without regard to sign) for all being 13 pounds. The average error of the "specification type" cars involved in the group of 19 standardizations just considered was only 4 pounds, whereas the average error of the "non-specification" cars of the group was 21 pounds.

Sixteen weighings of test weight cars were made in the field. Four cars were found heavy (average 28 pounds), 7 cars were found light (average 25 pounds), and 5 cars were found accurate within the precision inherent in the method of weighing necessarily followed in the field; the average numerical error (without regard to sign) of the 16 cars, as found, was 18 pounds.

